



## The Design of Notion and PhET-Based Interactive Website for Teaching Materials on the Topic of Linear Motion in Senior High School

Azurulia Maurilla Syifa\*, Alex Harijanto and Lailatul Nuraini

Physics Education, Universitas Jember, Jember, Indonesia

\*[azuruliasyifa@gmail.com](mailto:azuruliasyifa@gmail.com)

DOI:10.20527/bipf.v12i3.19297

Received: 19 June 2024 Accepted: 10 September 2024 Published: 18 October 2024

### Abstract

The learning process running in the 21st century has been integrated with technology and can be accessed easily anywhere and anytime. This research aims to describe the results of website design for interactive teaching materials assisted and describe the responses of teachers and students to interactive website teaching materials assisted by Notion and PhET on the topic of linear motion in senior high school. This research uses the Multimedia Development Life Cycle (MDLC) model design to create an interactive design website. There are six steps: concept, design, material collection, manufacture, testing, and distribution with research data collection methods, namely by conducting interviews, observation, documentation, and questionnaires. Based on research, the design of an interactive teaching material website with the help of Notion on the topic of linear motion received a really good response from teachers and students and can be used for learning in senior high school.

**Keywords:** learning; interactive; MDLC; notion; response

© 2024 Berkala Ilmiah Pendidikan Fisika

**How to cite:** Syifa, A.M., Harijanto, A., & Nuraini, L. (2024). The design of notion and PhET-based interactive website for teaching materials on the topic of linear motion in senior high school, *Berkala Ilmiah Pendidikan Fisika*, 12(3), 411-424.

### INTRODUCTION

The developments between education and technology can be called educational technology (Akbar, 2019). The learning process running in the 21st century has been integrated with technology and can be easily accessed anywhere and anytime. Technology is one of the keys to the biggest changes occurring in education; integrating technology into education can bring many benefits, such as media, multimedia, and the internet (Bhat, 2023; Lestari, 2018). Educational technology is the use of systems used in learning to achieve learning goals and obtain desired results. Integrating education into technology, as Bahri

(2023) has done, uses the Google Sites website as a learning medium.

Previous learning activities were only carried out in class. However, technology allows learning to be carried out anywhere and anytime. When the learning process takes place, students need media that can be used as a reference for themselves to learn. These references are known as teaching materials. Teaching materials have a positive effect on students when used in learning (Pratiwi, 2018). Thus, good teaching materials will make students interested, learning will be interactive, and learning will be easier and of a higher quality. Based on the results of observations and interviews with the



Physics teacher at MAN 1 Jember, in learning activities, the teaching and learning process still relies on printed teaching materials in the form of student worksheets. After learning is over (the material provided has been completed), only a written exam is given, and the learning is complete. Carrying out these activities can cause students to become bored, and sometimes, they can become resentful because the learning is not very interesting. Based on the results of interviews, several students felt bored and still needed to clearly understand the concept of the material being taught due to a lack of practice and uninteresting explanations.

The integration of interactive website teaching materials assisted by the Notion and PhET applications is a development in educational technology and one of the solutions that can be used in the learning process. According to Albab et al. (2021); Cahyani (2023); Siallagan (2024), Notion is an application that is often used to increase productivity, such as managing schedules, forming habits, and doing work from home (WFH). However, female students are using Notion as a learning medium, which means the Notion application can be used as a learning medium in teaching materials. Notion has a function like a website, namely as a container for teaching materials, but it has a more attractive appearance than a website. PhET is a virtual laboratory that students use to carry out practicums anywhere and anytime. Learning using PhET simulation can positively influence students to understand physics concepts, as Werdhiana (2024) has done. Raihanah (2019) has declared that PhET can increase activity and learning outcomes.

Linear motion is one of the materials students study when taking Physics subjects in high school. Students are required to understand, analyse, and apply the material obtained. Integrating interactive website teaching materials

assisted by Notion and PhET on Linear Motion in high school is one solution for students to learn through these teaching materials. Based on research conducted by Irianto et al. (2022), learning media in digital teaching materials received a good assessment by experts regarding material 97.5%, language 100%, and media 82.5%. When given to students, they received a good response regarding material 96.7%, use 100% and appearance 100%. Therefore, the researcher is interested in conducting research with the title "The design of notion and phet-based interactive website for teaching materials on the topic of linear motion in senior high school" to describe the creation of teaching material designs, describing the responses of teachers and students regarding the design of interactive website teaching materials with the help of Notion and PhET on the subject of linear motion.

**METHOD**

This research used the Multimedia Development Life Cycle (MDLC) model designed by Luther (1994) because this model is very easy to design something, especially creating teaching materials. There are six stages in the MDLC model by Luther and Sutopo (Ulandari, 2023),

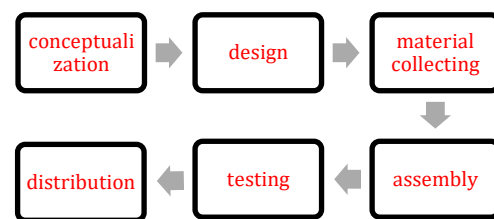


Figure 1 Steps MDLC model

Analysis of teacher and students' response data using response assessment scoring is in Table 1.

Table 1 Response assessment scoring

Score	Category
5	Strongly agree (SA)
4	Agree (A)
3	Less agree (LA)

Score	Category
2	Disagree (D)
1	Strongly disagree (SD)

(Sugiyono, 2017)

The response data is in percentage form, then adjusted to the criteria listed in Table 2.

Table 2 Criteria response

Intervals	Category
$100\% \geq P \geq 80\%$	Very good
$80\% \geq P > 60\%$	Good
$60\% \geq P > 40\%$	Fair
$40\% \geq P > 20\%$	Poor
$P > 20\%$	Very poor

(Arikunto, 2016)

### RESULT AND DISCUSSION

This research was carried out at MAN 1 Jember in class. This research used the subject matter of linear motion taught in class X MIPA odd semester. The initial research was conducted through follow-up interviews with the Physics subject teacher and carrying out observation activities in class. While observing learning activities, students use UKBM,

and the teacher's explanations are used as basic guidance for studying the material. The design of interactive website teaching materials with the help of Notion and PhET on the subject of linear motion is designed based on the MDLC process, where in MDLC, there are six stages: conceptualising, designing, collecting materials, manufacturing, testing, and distribution. Conceptualisation (concept): At this stage, the researchers were required to carry out the initial stages to produce a design of desired teaching materials that anyone can use and utilise in the future. Thus, at this stage, the researchers got a concept for creating teaching materials that can be used and accessed anywhere. Therefore, if you want a concept like this, teaching materials must be online, and a website is one solution. Physics, a subject matter that requires more or less extensive knowledge, is chosen as the material used in teaching materials. Table 3 explains the initial conceptualisation process for designing teaching materials.

Table 3 Conceptual process in designing interactive website teaching materials

Conceptualisation	In designing teaching materials
Identify Places and Research Subjects	Implementation of research at MAN 1 Jember with class X BIC 1 as research subjects
Curriculum Analysis, Core Competencies, and Basic Competencies	The use of an independent curriculum with core competencies is (1) Understanding, applying, and analysing factual, conceptual, and procedural knowledge based on curiosity about science, technology, arts, culture, and humanities in the areas of humanity, nationality, statehood, and civilisation-related to the causes of phenomena and events, as well as applying procedural knowledge in specific fields of study according to their talents and interests to solve problems and (2) Processing, reasoning and presenting in concrete and abstract domains related to the development of what they learn at school independently, and being able to use methods according to scientific principles. The basic competencies are (1) analysing physical quantities in linear motion with constant (fixed) speed and linear motion with constant (fixed) acceleration and their application in everyday life, for example, traffic safety, and (2) presenting data and graphs experimental results of object motion to investigate the characteristics of linear motion with constant (fixed) speed and linear motion with constant (fixed) acceleration and their physical meaning.

<b>Conceptualisation</b>	<b>In designing teaching materials</b>
Material Analysis	Linear Motion
Determining Applications	Notion and PhET

**Design**

At this stage, the researchers began to sort out how they wanted the appearance of the website page for each discussion of the subject matter. The design of interactive website teaching materials is shown in Figure 2.

Judul Materi				
Motivasi untuk siswa				
Pengenalan sekilas tentang Notion				
Kurikulum	Kompetensi Inti			Kompetensi Dasar
Apersepsi dan pengenalan konsep gerak lurus				
Pembelajaran 1	Jarak	Perpindahan	Kelajuan & Kecepatan	Percepatan
Pembelajaran 2	Gerak Lurus		Gerak Lurus Beraturan	Gerak Lurus Berubah Beraturan
Pembelajaran 3	Gerak Jatuh Bebas	Gerak Vertikal	Gerak Vertikal Keatas	Gerak Vertikal Kebawah
Quiz				
Praktikum Gerak Lurus				

Figure 2 Design of interactive website teaching materials with the help of Notion and PhET on the subject of linear motion in high school

**Material collecting**

At this stage, the researchers searched for materials that can be used and placed on the interactive website teaching material design so that when making the teaching material design, the researcher only needs to place the materials in their place according to the display design that has been prepared. The materials prepared include subject matter regarding linear motion, images related to linear motion, animations relating to linear motion, quiz embed links using quizzes and practicums using PhET.

**Assembly**

At this stage, the researchers have collected the needed materials and carried out the previous stages to obtain the desired material design. The following are the steps for designing interactive website teaching materials on the subject of linear motion in high school with the help of Notion and PhET.

- Access the Notion page to create an account using the following link: <https://www.notion.so/>. A display like Figure 3 appears.

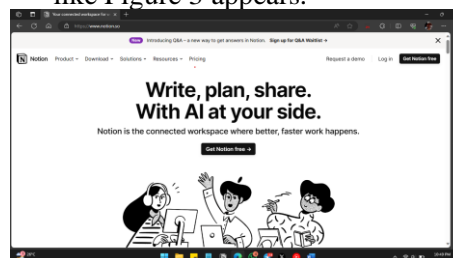


Figure 3 Notion home page

- Click in the top right corner where it says "Get Notion Free." Register to create an account and access Notion. It is recommended to use it on your campus/schoolster because you will get better features. Then, a display like Figure 4 will appear.

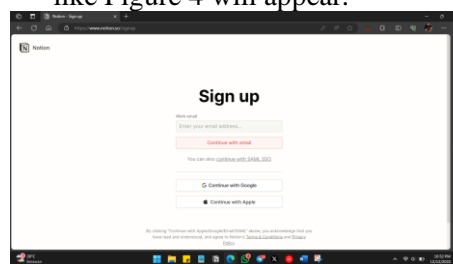


Figure 4 Design arrangement of interactive website teaching materials assisted by Notion and PhET on the topic of linear motion in senior high school

- Suppose the display already displays the Notion page, as in Figure 4. In that case, the topic of linear motion material that has been prepared can be directly entered into Notion with a layout that has been designed at the beginning of the research process. The way to enter text is just by typing, the same as writing on a document, and you can also copy text from a prepared document.

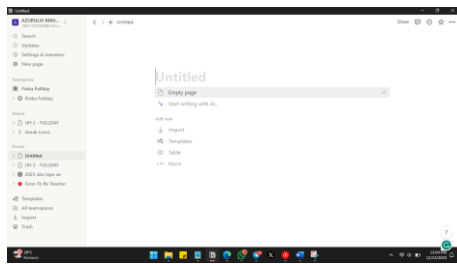


Figure 5 Page for designing teaching materials

- The main topic of linear motion used in teaching materials, with the correct systematic material included in Notion, can be done by copying the writing as usual in a document. Writing the subject matter of linear motion material must start from the concept or basic material and progress to advanced material. The design of the teaching materials will be as shown in Figure 6.

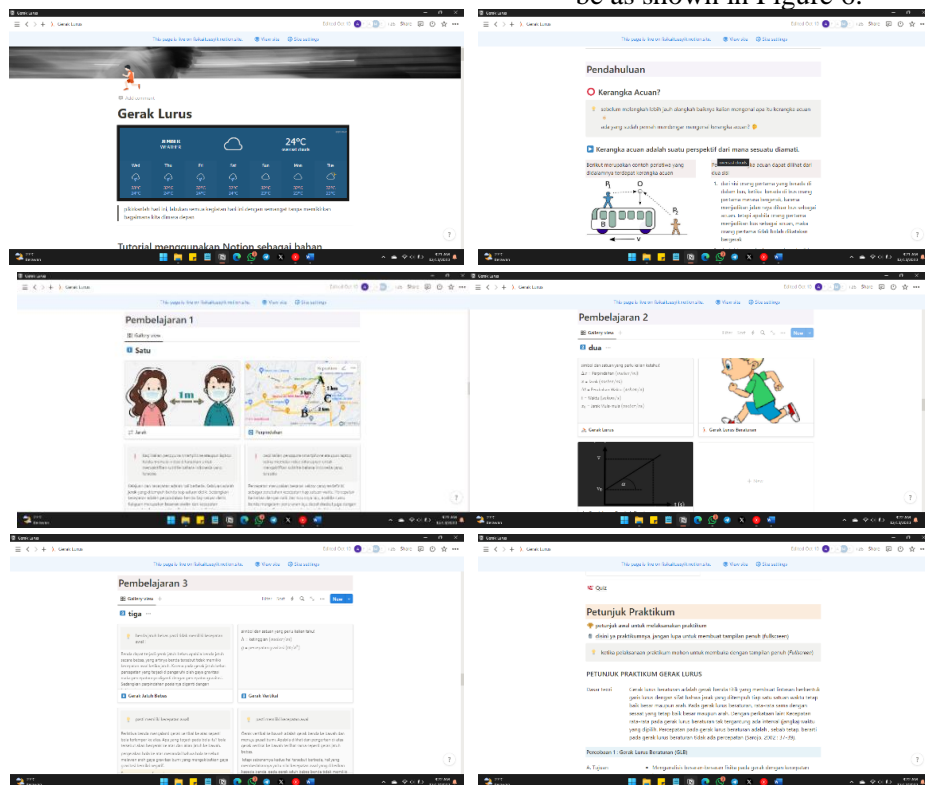



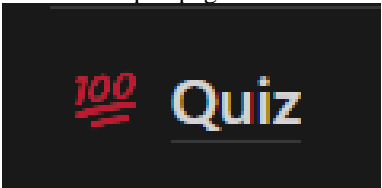

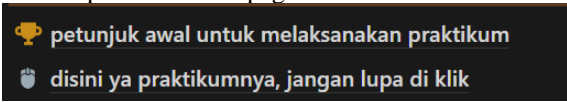



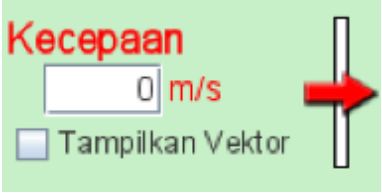
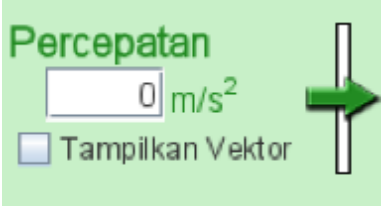

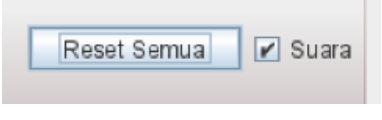
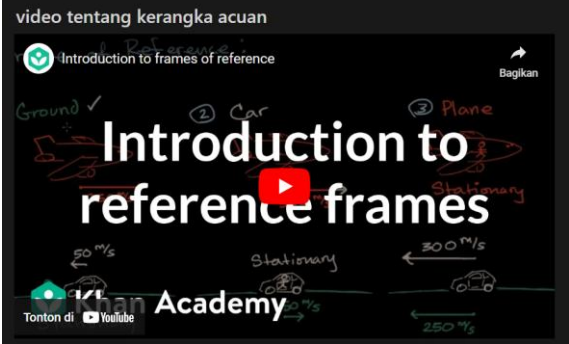

Figure 6 Design interactive website teaching materials

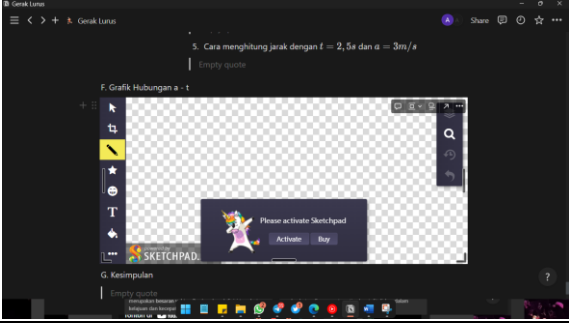
- After designing interactive website teaching materials with the help of Notion and PhET, the main language of linear motion in high school has been completed. The next stage is to make the design of the teaching materials accessible online and on a website by clicking the "share" button at the top right.
- Then the "share" menu will appear, select the "publish" section and click publish. So, designing teaching materials can be accessed by everyone who has the link, <https://physicsituasyik.notion.site/Gerak-urus9972dca0a854474fb14e637ad17de86f?pvs=4>
- Testing: At this stage, the researchers submitted the results of the design of teaching materials to the validator to test their suitability. The validator carried out the testing process, and the validator was given an expert judgment sheet, which is used to carry out testing on the design of interactive website teaching materials assisted by

Notion and PhET on the subject of school, as in Table 4.  
 movement linear in senior high

Table 4 The results of the design of teaching materials to the validator to test their suitability

Function	Expected results	Results obtained
Link home page, “ <a href="https://fisikaituasyik.notion.site/Gerak-Lurus-9972dca0a854474fb14e637ad17de86f?pvs=4">https://fisikaituasyik.notion.site/Gerak-Lurus-9972dca0a854474fb14e637ad17de86f?pvs=4</a> ” 	Show Page Home	Functioned
Column curriculum, Core competencies, and Basic competencies 	Show curriculum, Core competencies, and Basic competencies	Functioned
Link to home page 	Can back to the home page	Functioned
Link to the quiz page 	Can back to the quiz page	Functioned
Show quiz page 	Show quiz page	Functioned
Link to practical work page 	Can to practical work page	Functioned
Slide the position button on the practical work page 	The slider button can slide well	Functioned

Function	Expected results	Results obtained
<p>Speed slider button on the practical work page</p> 	<p>The slider button can slide well</p>	<p>Functioned</p>
<p>Acceleration slider button on the practical work page</p> 	<p>The slider button can slide well</p>	<p>Functioned</p>
<p>Play button on the practical work page</p> 	<p>The play button can play well in practical work</p>	<p>Functioned</p>
<p>Reset button on the practical work page</p> 	<p>Can function adequately so can start from the beginning of practical work</p>	<p>Functioned</p>
<p>Video Reference</p> 	<p>Video can play well</p>	<p>Functioned</p>
<p>Material page</p> 	<p>The link will take you to the page according to your study topic.</p>	<p>Functioned</p>

Function	Expected results	Results obtained
A page for drawing graphs 	It can function well so that it can describe the relationship being analyzed	Functioned

Several functions were given and tested during the testing process. There are 14 functions, namely links to the design of teaching materials, curriculum pages for core competencies and basic competencies, links to the home page, quiz; quiz page, practical page, position shift button, speed and acceleration on the Practicum Page, and the play button on the Practicum Page, reset button on the Practicum Page, Reference video, Material page, drawing graphs. From several of these functions, we got good

functions and received several revisions so that adjustments were made and the effectiveness of the use of designed teaching materials was made.

Teachers' responses to the design of interactive website teaching materials on the topic of linear motion using Notion and PhET, using Google Forms to obtain data. The data obtained after distributing the questionnaire to teachers is below in Table 5.

Table 5 Results of teacher responses to the design of teaching materials

Teacher Response Indicators	P	Category
The suitability of the material and objectives in the interactive website teaching materials assisted by Notion and PhET is really good.	100%	Very good
Good order of presentation of material on interactive website teaching materials assisted by Notion and PhET.	100%	Very good
The accuracy of illustrations in interactive website teaching materials assisted by Notion and PhET is really good.	100%	Very good
The completeness of the information on the interactive website teaching materials assisted by Notion and PhET.	80%	Good
The interactive website teaching materials Notion and PhET assisted are easy to learn.	100%	Very good
Using language in interactive website teaching materials assisted by Notion and PhET is easy to understand.	100%	Very good
Accessing interactive website teaching materials assisted by Notion and PhET is easy.	100%	Very good
Easy-to-use interactive website teaching materials assisted by Notion and PhET.	100%	Very good
The availability of examples and illustrations on interactive website teaching materials assisted by Notion and PhET can improve students' understanding of the material.	100%	Very good
Interactive website teaching materials assisted by Notion and PhET can be used as learning media to facilitate teaching and learning activities.	100%	Very good
Use good order and letters in interactive website teaching materials assisted by Notion and PhET.	100%	Very good



Teacher Response Indicators	P	Category
The use of illustrations, animations, and photos in interactive website teaching materials assisted by Notion and PhET is really good.	60%	Good
Design an attractive appearance on interactive website teaching materials with the help of Notion and PhET.	80%	Good
Total	93.84%	Very good

Student responses to interactive website teaching materials assisted by Notion and PhET to determine student responses to these teaching materials. To obtain student response data, researchers used a response questionnaire with the

help of Google Forms to distribute it to students. The questionnaire was distributed to 36 students of class X BIC 1 Madrasah Aliyah Negeri 1 Jember. The results obtained based on the questionnaire are presented in Table 6.

Table 6 Results of student responses to the design of teaching materials

Students Response Indicators	P	Category
I find the interactive website teaching materials on linear motion, assisted by Notion and PhET, easy to understand.	82.2%	Very good
I can learn systematically because the sequence of material presented is correct.	82.2%	Very good
I can improve my knowledge of the material after accessing the quiz.	81,7%	Very good
I can carry out virtual practicums using PhET well.	77,2%	Good
I can understand the material presented because of the good use of language.	83,9%	Very good
I can carry out discussions well on interactive website teaching materials with the help of Notion and PhET.	83,3%	Very good
I felt helpful after using interactive website teaching materials assisted by Notion and PhET.	81,7%	Very good
I like the choice of letters, size, and spacing used in interactive website teaching materials assisted by Notion and PhET.	81,1%	Very good
Interactive website teaching materials assisted by Notion and PhET make me more enthusiastic about studying Physics.	86,1%	Very good
I can understand examples and illustrations of the material on interactive website teaching materials assisted by Notion and PhET well.	82,2%	Very good
I like the arrangement of the interactive website teaching materials assisted by the Notion and PhET applications.	81,7%	Very good
I like the appearance of the interactive website teaching materials assisted by the Notion and PhET applications.	79,4%	Good
Total	80,3%	Good

Based on Table 5 and Table 6, the average percentage of student and teacher responses to the design of interactive website teaching materials assisted by Notion and PhET on the topic of linear motion in high school was obtained by teacher responses of 93.84%

in the really good category and student responses of 80.3% with a really good response category.

**Distribution**

At this stage, the students were given design teaching materials, and their

accounts were linked to Notion, so the distribution process was quite easy. Just send an email to students who are registered with Notion, or you can directly access the following link to see the design of teaching materials page. The distribution process is gradual and carried out via WhatsApp. <https://fisikaituasyik.notion.site/Gerak-Lurus-9972dca0a854474fb14e637ad17de86f?pv=4>

Figure 7 shows the overview website interactive with Notion.

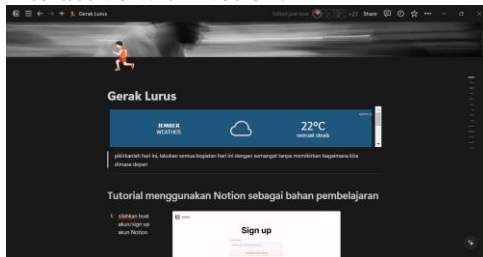


Figure 7 Home page linear motion page on Notion

This research aims to describe the design of interactive website teaching materials assisted by Notion and PhET on linear motion in high school. Thus, the results obtained from this research are the design of teaching materials that can be accessed on various platforms with Internet access. Without internet access, it can still be used to read the material, but moving media will be limited. This teaching material design displays material, applications, practice questions, quizzes, and practicums. The design of this teaching material uses an MDLC design that has six stages, namely a) conceptualisation, b) design, c) material collecting, d) assembly, e) testing, and f) distribution.

The concept stage is the first step for researchers to determine the applications that will be used in designing teaching materials and can create interesting teaching materials so that these materials use Notion and PhET's help. Next, planning is carried out, creating a framework for teaching materials and

determining the location of each part. This teaching material consists of several parts: the home page, curriculum page, ki, kd, learning material page, quiz page, and practicum page. The pages were arranged vertically in sequence. Material collecting stage: This stage was carried out by a literature study, collecting linear motion material, creating image objects, collecting images and animations, and learning videos. Materials were collected from various sources, most obtained from Google and personal sources. Next is the assembly stage, which can be carried out if the next stage has been carried out well in terms of concept, design, and materials. The design of this teaching material aims to make it easier for teachers and students to learn and requires that this teaching material be interactive so that lots of pictures, animation, practical work, and detailed explanations must be provided. This follows the statement that media in images, animation, and practicum can make students more active and interactive in learning.

The testing stages were carried out using an expert judgment sheet using the Black Box method, which researchers and supervisors carried out to determine the functionality and feasibility of using the website teaching material design. Test results show suitability for function. The test results can be seen more clearly in Table 4.2. A note that needs to be improved is the effectiveness of virtual practicum links that use assistance PhET. Based on these notes, improvements are then made so that the website teaching material design is ready to proceed to the next testing stage. The next testing stage was conducted directly at the place where the research was conducted, namely at MAN 1 Jember with a class X physics teacher and 36 class X BIC 1 students. Testing begins by introducing the Notion application and demonstrating the design of website teaching materials. Next, teachers and students were asked to fill

out a response questionnaire regarding the design of interactive website teaching materials assisted by Notion and PhET on linear motion. Based on BSNP in PP No. 19/2005 article 43 paragraph 5, the teacher and student response questionnaire is structured by several aspects, namely: 1) content suitability aspect, namely the suitability of the material presented in the design of teaching materials, 2) language suitability aspect, namely the suitability of the language used and the ease of information provided. Conveyed, 3) aspects of appropriateness of presentation, namely ease of use of teaching materials, in interacting and accessing teaching materials, 4) aspects of appropriateness of graphics, suitability of use of illustrations, and display design of teaching materials.

Teacher and students' response questionnaire sheets were used to determine the feasibility and response to the design of interactive website teaching materials assisted by Notion and PhET. After the demonstration, questionnaires were given to teachers and students, and an average percentage of teacher responses was obtained at 93.84%, and student responses were obtained at 80.3%. Based on Tables 4 and 5, the average percentage value of student and teacher responses is included in the really good category. It can be concluded that the design of interactive website teaching materials assisted by Noion and PhET on linear motion in high school is feasible and can be used as a learning medium in schools. This is in line with what was done by Irianto *et al.* (2022); learning media in digital teaching materials received a good assessment.

Some of the aspects tested include the aspect of content suitability. In the content suitability aspect, there are four indicators for teachers and students: 1) suitability of the material, 2) order of presentation of the material, 3) appropriateness of the use of illustrations,

and 4) completeness of the information. The percentage of teacher responses was 95% in the really good category, and student responses were 80.8% in the really good category. Based on the percentage of content suitability scores, this aspect received a really good response. The next aspect, namely the aspect of appropriateness of language in the teacher's response, has two indicators 1) The interactive website teaching materials assisted by Notion and PhET are really easy to learn, and 2) The use of language in the interactive website teaching materials assisted by Notion and PhET is very easy to understand, getting a percentage of 100 % in the really good category. In student responses, one indicator is understanding the material presented because the use of good language gets a percentage of 83.9% in the really good category. Thus, it can be concluded that the appropriateness aspect of the language can be considered very good.

There are four indicators regarding the feasibility of presentation in teacher responses, namely: 1) access to interactive website teaching materials; 2) ease of using interactive website teaching materials; 3) availability of examples and illustrations on interactive website teaching materials; and 4) interactive website teaching materials assisted by Notion and PhET can be used as a learning medium to make teaching and learning activities easier. The percentage obtained from teacher responses was 100% in the really good category. There are four indicators regarding the feasibility aspect of student responses, namely 1) having discussions on interactive website teaching materials, 2) being helped after using interactive website teaching materials, 3) the choice of letters, size, and spacing used on interactive website teaching materials, and 4) materials of the interactive website teaching make the students more enthusiastic about studying physics,

getting a percentage of 80.3% in the really good category. Based on these results, this aspect is very good.

Finally, regarding the appropriateness of graphics, in the teacher's response, there are three indicators, namely 1) the use of good layout and letters on interactive website teaching materials, 2) the use of illustrations, animations, and photos on interactive website teaching materials, and 3) attractive appearance design on the materials. Teach interactive websites with a percentage of 80% in the very good category. Meanwhile, there are three indicators regarding the appropriateness of graphics in student responses, namely 1) understanding examples and illustrations regarding the material on interactive website teaching materials, 2) liking the layout of interactive website teaching materials, and 4) liking the appearance of interactive website teaching materials. Getting a percentage of 82.04 % in the really good category, the graphic feasibility aspect is classified as very good.

One obstacle that occurs when carrying out research is inadequate internet access. When carrying out research in each class, class WiFi is provided. However, suppose all students use the internet simultaneously. In that case, the internet speed for each user will be reduced to adjust the specified bandwidth so that several students can use mobile hotspots while demonstrating the design of interactive website teaching materials. Then, there were problems with several students who wrote down the email addresses they had registered incorrectly in the Notion application, so the invitation process was quite hampered due to a writing error. Then, a solution was provided, namely directly providing an invitation link to students experiencing this problem. Based on the feasibility analysis for designing interactive website teaching materials with the help of Notion and PhET, the

topic of linear motion is included in the really good category.

## CONCLUSION

The conclusion obtained based on the results of this research is that the design of interactive website teaching materials assisted by Notion and PhET on the subject of linear motion can be used and implemented well based on expert judgment validation and responses from both teachers and students to interactive website teaching materials assisted by Notion and PhET on the subject. Linear motion is stated to be good. The design of interactive website teaching materials assisted by Notion and PhET on the subject of linear motion can be used generally by students as a reference or addition. Designing interactive website teaching materials with the help of Notion and PhET on the subject of linear motion is an innovation to update more independent teaching materials. However, this research only focuses on linear motion, so it is hoped that it can be developed using wider material.

## REFERENCES

- Akbar, A., & Noviani, N. (2019). Tantangan dan solusi dalam perkembangan teknologi pendidikan di Indonesia. *Prosiding Seminar Nasional Pendidikan Program Pascasarjana Universitas PGRI Palembang*, 2(1).
- Albab A. N., Alfiansyah, F., Faisal Dzaki, M. S., Kurniawan, E., Dharmawan, D., Athallah, N. H., Ahmad, M., Zaky, M. A., Fahri Shihab, A., Windi, R. S., & Djutalov, R. (2021). Memperkenalkan aplikasi Notion untuk membantu produktivitas siswa dan siswi smk pancakarya 2 tangerang. *Tangerang. Jurnal Kreativitas Mahasiswa Informatika*, 2, 214–217.
- Almakhsum, A. N. M. (2018). Implementasi bahan ajar pai berbasis media sosial edmodo di sma n 13

- bandar lampung. (Skripsi Sarjana, UIN Raden Intan Lampung).
- Amala, I., Indrawati, I., & Wicaksono, I. (2020). Efektifitas aplikasi phet disertai lks materi gerak dan gaya untuk pembelajaran ipa di smp. *EduFisika*, 5(02). <https://doi.org/10.22437/edufisika.v5i02.9960>
- Anggraeni, L., Matsun, M., & Eka T. (2019). Pengembangan buku ajar ipa terpadu smp berbasis eksperimen. *Lectura: Jurnal Pendidikan*, 10(2).
- Arikunto, S. (2016). *Prosedur penelitian suatu pendekatan praktik*. Jakarta: Rineka Cipta.
- Assiddiqi, B. A., Nuraini, L., Murniati, M. E., Azura, S. H., Safitri, V., & Yuliyantika, Y. (2023). Rancang bangun media pembelajaran e-learning berbantuan website berdu.id pokok bahasan etnofisika. *Jurnal Education and Development*, 11(2), 95-100.
- Bahari, F., Diah, A. K. W., Lintang, P., Nur, A. P. F., & Lailatul, N. (2023). Rancang bangun media pembelajaran berbasis website google sites pada materi astronomi. *Edukasi: Jurnal Pendidikan*, 21(1). <https://doi.org/10.31571/edukasi.v21i1.5212>
- Bhat, R. A. (2023). The impact of technology integration on student learning outcomes: A comparative study. *International Journal of Social Science, Educational, Economics, Agriculture Research and Technology (IJSET)*, 2(9): 592-596.
- Cahyani, A., Agustin, D., Muslimah, I., & Khulliyatunnisa, N. (2023). Peran aplikasi notion dalam perkuliahan untuk mewujudkan produktivitas mahasiswa. *Jurnal Pendidikan, Sains Dan Teknologi*, 2(1): 262-273.
- Eliyarti, Zakirman, & Rahayu, C. (2020). Penerapan bahan ajar Fisika dengan variasi bentuk tugas berbasis web untuk meningkatkan hasil belajar mahasiswa teknik. *Jurnal Pendidikan Fisika Undiksha*, 10(2).
- Hadiyanti, A. H. D. (2021). Pengembangan modul pembelajaran ipa digital berbasis flipbook untuk pembelajaran daring di sekolah dasar. *Jurnal Elementaria Edukasia*, 4(2). <https://doi.org/10.31949/jee.v4i2.3344>
- Khairiyah, U., & Faizah, S. N. (2020). Respon siswa terhadap penggunaan modul tematik dalam meningkatkan kemampuan berpikir kritis. *Elementeris: Jurnal Ilmiah Pendidikan Dasar Islam*, 2(1), 1. <https://doi.org/10.33474/elementeris.v2i1.4903>
- Lestari, S. (2018). Peran teknologi dalam pendidikan di era globalisasi. *EDURELIGIA; Jurnal endidikan Agama Islam*, 2(2), 94–100. <https://doi.org/10.33650/edureligia.v2i2.459>
- Magdalena, I., Sundari, T., Nurkamilah, S., & Ayu Amalia, D. (2020). Analisis bahan ajar. *Jurnal Pendidikan dan Ilmu Sosial*, 2(2).
- Margo I. D., Herlambang, Y. T., Yunansah, H., & Wahid, R. (2022). Rancang bangun bahan ajar digital berbasis Ekopedagogik Approach. *NATURALISTIC: Jurnal Kajian Penelitian Pendidikan Dan Pembelajaran*, 6(2). <https://doi.org/10.35568/naturalistic.v6i2.1813>
- Marsa, P. B., & Desnita, D. (2020). Analisis media, sumber belajar, dan bahan ajar yang digunakan guru Fisika SMA materi gelombang di Sumatera Barat ditinjau dari kebutuhan belajar abad 21. *Jurnal Eksakta Pendidikan (JEP)*, 4(1). <https://doi.org/10.24036/jep/vol4-iss1/422>
- Maryani, M., Nisak, M. S., & Supriadi, B. (2022). Implementasi media pembelajaran berbasis web Google Sites untuk meningkatkan kemampuan memecahkan masalah siswa SMA pokok bahasan

- gelombang bunyi. *Jurnal Penelitian Pendidikan IPA*, 8(4), 2430–2438. <https://doi.org/10.29303/jppipa.v8i4.2037>
- Pratiwi, I. T. M., & Meilani, R. I. (2018). Peran media pembelajaran dalam meningkatkan prestasi belajar siswa. *Jurnal Pendidikan Manajemen Perkantoran*, 3(2), 33. <https://doi.org/10.17509/jpm.v3i2.11762>
- Raihanah, S., Susilowati, E., & Salam, A. (2019). Increasing students' activity and learning outcome used guided discovery model assisted by PhET. *Berkala Ilmiah Pendidikan Fisika*, 7(2), 123-133.
- Siallagan, G. N. A., Komariyah, L., & Nuryadin, A. (2024). Development of digital teaching materials on notion application-based thermodynamics materials with higher order thinking skill instruments for high school students in class xi. *PENDIPA Journal of Science Education*, 8(1), 70–77. <https://doi.org/10.33369/pendipa.8.1.70-77>
- Sugiyono, S. (2017). *Metode penelitian kuantitatif, kualitatif, dan research development*. Bandung: Penerbit Alfabeta.
- Ulandari, I. T., & Efriyanti, L. (2023). Perancangan media pembelajaran berbasis augmented reality pengenalan akomodasi perhotelan di SMK Global Pariaman. *ANTHOR: Education and Learning Journal*, 2(2). <https://doi.org/10.31004/anthor.v2i2.121>
- Verdian, F., Jadid, M. A., & Rahmani, M. N. (2021). Studi penggunaan media simulasi PhET dalam pembelajaran Fisika. *Jurnal Pendidikan Dan Ilmu Fisika*, 1(2). <https://doi.org/10.52434/jpif.v1i2.1448>
- Walker, J., Halliday, D., & Resnick, R. (2014). *Fundamentals of physics halliday & resnick 10th edition*. In Wiley.
- Werdhiana, I. K., Kamaluddin, K., Syamsuriwal, S., & Astuti, N. M. W. Online learning using phet simulation videos and real laboratory videos for students' understanding of the hydrostatic pressure concept. *Berkala Ilmiah Pendidikan Fisika*, 11(3), 440-451.